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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. 07012/0100 30,005
First Inventor or Application Identifier Slattery, Ian
Title TUFTING MACHINE YARN FEED PATTERN CONTROL
Express Mail Label No. EI177927023US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

- ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
- ☒ Specification [Total Pages 11]
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the invention
 - Brief Summary of the invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
- ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 2]
- Oath or Declaration [Total Pages 2]
 - ☒ Newly executed (original or copy)
 - ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

- ☐ Microfiche Computer Program (Appendix)
- Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
 - ☐ Computer Readable Copy
 - ☐ Paper Copy (identical to computer copy)
 - ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

- ☐ Assignment Papers (cover sheet & document(s))
- ☐ 37 C.F.R. § 3.73(b) Statement of Power of Attorney
(when there is an assignee)
- ☐ English Translation Document (if applicable)
- ☐ Information Disclosure Statement (IDS)/PTO-1449 [Copies of IDS Citations]
- ☐ Preliminary Amendment
- ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
- ☒ * Small Entity Statement(s) filed in prior application, Status still proper and desired
(PTO/SB/09-12)
- ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
- ☐ Other: _____

* NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:
☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____
Prior application information: Examiner _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Label

or ☒ Correspondence address below

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Name (Print/Type)	Alan Ruderman	Registration No. (Attorney/Agent)	25,369
Signature		Date	3/25, 2000

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STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(c))—SMALL BUSINESS CONCERN

Docket Number (Optional)
07012/0100 30,005

Applicant, Patentee, or Identifier: Slattery, Ian

Application or Patent No.:

Filed or Issued: Filed herewith

Title: TUFTING MACHINE YARN FEED PATTERN CONTROL

I hereby state that I am

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN Spencer Wright Industries, Inc.

ADDRESS OF SMALL BUSINESS CONCERN 1731 Kimberly Park Drive, Dalton, Georgia
30720

I hereby state that the above identified small business concern qualifies as a small business concern as defined in 13 CFR Part 121 for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time, or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby state that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern, or organization having rights in the invention must file separate statements as to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization having any rights in the invention is listed below:

- ☒ no such person, concern, or organization exists.
☐ each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

NAME OF PERSON SIGNING Gary W. Hostetter

TITLE OF PERSON IF OTHER THAN OWNER Vice President

ADDRESS OF PERSON SIGNING 1731 Kimberly Park Drive, Dalton, Georgia 30720

SIGNATURE

Gary W. Hostetter

DATE

3-23-00

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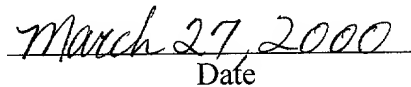
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Assistant Commissioner for Patents
Washington, D.C. 20231

The enclosed items are:

Fee Transmittal
Patent Application Transmittal
Patent Application (11 pages)
Drawings (2 pages)
Declaration and Power of Attorney
Statement Claiming Small Entity Status
Check for \$345.00
Return Postcard


Signed: Beverly L. Middleton


Date

TUFTING MACHINE YARN FEED PATTERN CONTROL

This invention relates to tufting machines and more particularly to a yarn feed pattern control for a tufting machine having a separate feed motor for each individual yarn end fed to the tufting machine for varying the pile height of each tuft selectively, thereby permitting a full repeat across the full width of the tufting machine.

It is well known in the carpet tufting art to utilize a yarn feed roller attachment for producing variations in pile height of loop pile products, and for producing cut and loop products wherein any particular needle may produce either a loop pile tuft or a cut pile tuft. The yarn feed rollers act either to feed the full amount of yarn to adequately accommodate the yarn requirements of the particular needle or to feed less than that adequate amount of yarn so as to backdraw or backrob yarn from the previous stitch. The backrobbing features are adequately described in the prior art, for example, U.S. Patent No. 2,862,465 in regard to loop pile and U.S. Patent No. 3,084,645 in regard to cut and loop products.

As described in U.S. Patent No. 5,182,997, each needle in the tufting machine may be controlled individually to either produce a high loop or a low loop by feeding yarn to each of the respective needles at a first or a second speed, the first and second speeds being different. The greater quantity of yarn fed at the highest speed provides an adequate amount of yarn for the needle while the slower speed supplies a lesser amount so as to backrob from the prior loop. The assembly there shown is known as a single end control

yarn feed roller assembly or a full repeat scroll and is a two pile height feed roller assembly. There are other feed roller assemblies of this type that may permit a third level to be formed by including an additional drive roll pair for driving the feed roll at a third speed intermediate the first and second speeds.

5 Recently, with the improvements made in the art of servo motors wherein such motors have been made smaller and quick acting, it is now possible to drive a single yarn end by a respective servo motor to each individual needle. This provides the ability to feed each yarn at a multitude of speeds to each needle so that a substantial number of pile heights may be produced by each individual needle. This gives the carpet designer a substantially greater arsenal of design capabilities than heretofore possible. For example, certain needles may be threaded with different color yarns and a particular color yarn may be hidden in the carpet at a first location and yet show slightly at a different location in the direction the carpet is being fed, and show up even more at still other locations so that various shading effects may be created. Additionally, different effects may be created in cut and loop carpets of the type manufactured using the method disclosed in U.S. Patent No. 3,084,645 and in level cut and loop carpet such as the type produced using the method illustrated in U.S. Patent No. 4,185,569.

15 When one considers that a full sized tufting machine such as a 4 meter or a 15 foot machine having a 1/8 gauge, i.e., 1/8 inch between rows of needles, may have as many as approximately 1298 needles such that multi-level single end control of the yarn being fed

would require approximately 1298 servo motors, it can be seen that there is a massive number of yarn ends being fed to the needles and that some means must be found to mount the motors and direct the yarns for threading the proper needle or the massive number of yarns would be intermingled or intertwined and concatenated and make it extremely difficult for threading the needles. If a particular yarn does not go to the proper needle, the pattern would be defective which may result in wasted fabric.

SUMMARY OF THE INVENTION

Consequently, it is a primary object of the present invention to provide a yarn feed pattern assembly for a tufting machine that permits full control of the pattern repeat across the width of the tufting machine permitting each needle to receive a respective yarn fed at a multiplicity of speeds selectively.

It is another object of the present invention to provide a yarn feed pattern assembly for a tufting machine having an individual motor drive assembly for each needle to permit feeding of the yarn at different selective rates to each respective needle of the tufting machine.

It is a further object of the present invention to provide a yarn feed roller pattern assembly for attachment to a tufting machine, the assembly having an individual motor drive assembly for each needle and having a yarn guide system for guiding a yarn to and from each respective motor drive assembly.

Accordingly, the present invention provides a tufting machine having a yarn feed pattern assembly including a housing having a mounting plate for mounting a multiplicity of servo motors, each servo motor preferably corresponding to one needle in the tufting machine so that a full repeat pattern across the width of the tufting machine may be provided. Each servo motor carries a roller about which yarn is trained so as to be fed from a yarn source to the respective needle, the motor being mounted on one surface of the mounting plate and the roller being mounted on the other. Within the housing leading to and from each roller is a respective input and output tube, and the input tubes supplying yarn from the yarn source to the respective roller and the output tubes feeding yarn from the rollers to the respective needles. By maintaining the yarn in the housing within the guide tubes, the yarn is precluded from being entangled with other yarns and provides the machine operator with the ability to thread each particular needle with the correct yarn. For example, any particular servo motor may carry a particular number and the tubes extending thereto and therefrom may also be numbered to correspond with a particular needle. In this manner, the needles may be threaded correctly to provide the desired pattern.

The housing which carries the servo motors and rollers and in which the multitude of yarn guide tubes are mounted may be readily mounted as an attachment, so to speak, on the head of the tufting machine and the yarns fed to the machine may be directed to the needles from the housing conventionally.

BRIEF DESCRIPTION OF THE DRAWINGS

The particular features and advantages of the invention as well as other objects will become apparent from the following description taken in connection with the accompanying drawings in which:

5 Fig. 1 is a front elevational view of a tufting machine incorporating a yarn feed pattern attachment constructed in accordance with the principles of the present invention;

Fig. 2 is a fragmentary side elevational view of the machine illustrated in Fig. 1 with the end of the yarn feed pattern attachment housing removed;

10 Fig. 3 is a perspective view of a portion of the mounting plate of the yarn feed pattern attachment broken away and rotated relative to Fig. 2 to illustrate the servo motor and yarn drive associated therewith; and

Fig. 4 is a cross-sectional view taken substantially through line 4-4 of Fig. 1 at a greatly enlarged scale.

DESCRIPTION OF THE PREFERRED EMBODIMENT

15 Referring to the drawings, Figs. 1 and 2 illustrate a tufting machine **10** having a head **12** in which a plurality of transversely spaced push rods **14** is reciprocally mounted, the push rods carrying a needle bar **16** at the lower ends thereof. The needle bar **16** carries a multiplicity of needles **18**, which may be mounted in a single roll as illustrated or in two rows which may or may not be staggered relative to each other as well known in the art.

20 Moreover, rather than being a laterally fix needle bar, the needle bar **16** may be of the

laterally shiftable types as is well known in the art. In any event, the needles cooperate with corresponding respective loopers and hooks (not illustrated) conventionally mounted beneath the head as is notoriously well known in the art.

Mounted as an attachment on the head of the tufting machine is a yarn feed roller pattern assembly **20** constructed in accordance with the present invention. Yarn, such as yarn strands Y, Y_1, Y_2, Y_3, Y_4 , are supplied from a source such as a yarn creel (not illustrated) and are directed to the pattern attachment **20** and from the pattern attachment each yarn is directed to a respective separate needle **18**.

The yarn feed roll pattern attachment **20** comprises a housing having a front face plate **22** spaced from a rear plate **24**, the plates **22, 24** being connected together by end plates (not illustrated) so as to form a hollow housing having open upper and bottom portions. The rear plate **24** may be connected to the tufting machine by means of brackets **26** so that the yarn is readily available for threading to the multiplicity of needles.

Secured to and carried by the front face plate **22** are a multiplicity of yarn feed roll assemblies each including a respective servo motor **28**, there preferably being one servo motor for each needle **18**. As well known each servo motor may be controlled to rotate at variable selected speeds, and to this end electrical connectors **29,31** extend from the motors to a program controller (not illustrated). Each servo motor has an outer casing **30** which is connected by screws **32** or the like to the rear surface of the front face plate **22** while a yarn feed roller support plate **34** is connected by screws **35** to the front surface of

the plate **22** in superposed relationship relatively to the servo motor. The output shaft **36** of the each servo motor extends through the front plate **22** and the support plate **34** and is connected to a roll **38**, which, as illustrated, may have a pulley configuration. Thus the roller **38** may have a central circumferential recess within which a yarn may be trained. A lever arm **42** has one end pivotally mounted on the plate **34** and carries a disk or small roller **44** which is disposed to fit within the recess **40**, a coil spring **46** connected at one end to the lever **42** and at its other end to a post **48** on the plate **34** acting to bias the lever toward the roller **38** so that the disk **44** may place friction on the yarn that is within the recess **40**.

Adjacent each plate **34** is a pair of apertures within which a respective bushing **50**, **52** is fastened. A first yarn guide tube **54** preferably constructed from aluminum or plastic tubing is secured within each bushing **50** and is bent to extend upwardly toward and preferably beyond the top of the yarn feed roller assembly housing **20** while a similar tube **56** is secured within each bushing **52** and is bent to extend downwardly to adjacent the lower end of the housing **20**. A yarn end may thus be threaded into each tube **54** at the top, fed out the bushing **50**, about the pulley **38**, through the bushing **52**, through the corresponding tube **56** and thereafter directed to the respective needle **18**.

Each servo motor is rotatably driven at a selected variable speed to feed the respective yarn to the needle, the faster the motor is driven, the faster the roller **38** is

rotated and the greater the amount of yarn fed to that needle. If the amount of yarn fed is less than the amount required by the needle system during its reciprocating path, then yarn is backrobbed from the prior stitch to form a shorter loop in that prior stitch. The various speeds that the servo motor may be driven results in variations in the pile heights in the various stitches so that numerous patterns may be formed. Of course, as known in the art, the control to the servo motors may be by means of a conventional programmer or computer which is programmed with the desired pattern so that on each stitch the required amount of yarn is fed to each particular needle. Accordingly, a full repeat or single end control may be readily provided by the present invention in a simple manner.

Thus, the present invention provides a yarn feed roller assembly having a housing wherein the servo motors may be mounted on a plate of the housing and yarn guide tubes may be carried within the housing for guiding yarn to and from a yarn feed member driven by the servo motor. The yarn feed roller assembly thus insures that the correct yarn is fed to and from each particular servo motor controlled yarn feed member.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to the preferred embodiment of the invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus set forth the nature of the invention, what is claimed therein is:

1. A yarn feed roller assembly for a tufting machine comprising a hollow housing having a mounting plate, a multiplicity of drive rollers rotatably mounted on said mounting plate, a multiplicity of variable speed motors mounted on said mounting plate, each motor having an output shaft connected to one of said rollers, and a multiplicity of yarn guide tubes mounted within said housing, there being two guide tubes associated with each roller, one for directing yarn from a source to the roller and the other for directing yarn from the roller to the tufting machine.
2. A yarn feed roller assembly as recited in claim 1, wherein said mounting plate comprises an exterior wall of said housing and includes an exterior surface and an interior surface, said rollers extending from the exterior surface and said motors extending from said interior surface.
3. A yarn feed roller assembly as recited in claim 1, including a member for frictionally engaging each roller to apply a frictional force to yarn trained about said roller.

4. A yarn feed roller assembly as recited in claim 1, wherein said tufting machine includes a head and brackets for attaching said housing to said head.
5. A yarn feed roller assembly as recited in claim 1, wherein said housing is open at an upper end and a lower end, said guide tubes associated with said roller for directing yarn from a source to the roller extend from said upper end and the guide tubes associated with each roller for directing yarn from the rollers to the tufting machine extend to said lower end of said housing.

TUFTING MACHINE YARN FEED PATTERN CONTROL

ABSTRACT

A tufting machine has a yarn feed pattern assembly including a housing having a mounting plate for mounting a multiplicity of yarn feed rollers from the exterior of said mounting plate and a multiplicity of servo motors connected to said mounting plate on the interior of said housing. Each servo motor is connected to a respective feed roller. A multiplicity of tubes extend within said housing, half the tubes directing yarn from a source to respective rollers and half of the tubes directing yarn from the rollers to respective needles. The guide tubes direct yarn from the interior of said housing through said mounting plate where the yarn is trained about a respective roller and directed back into the yarn guide leading toward the needles of said tufting machine.

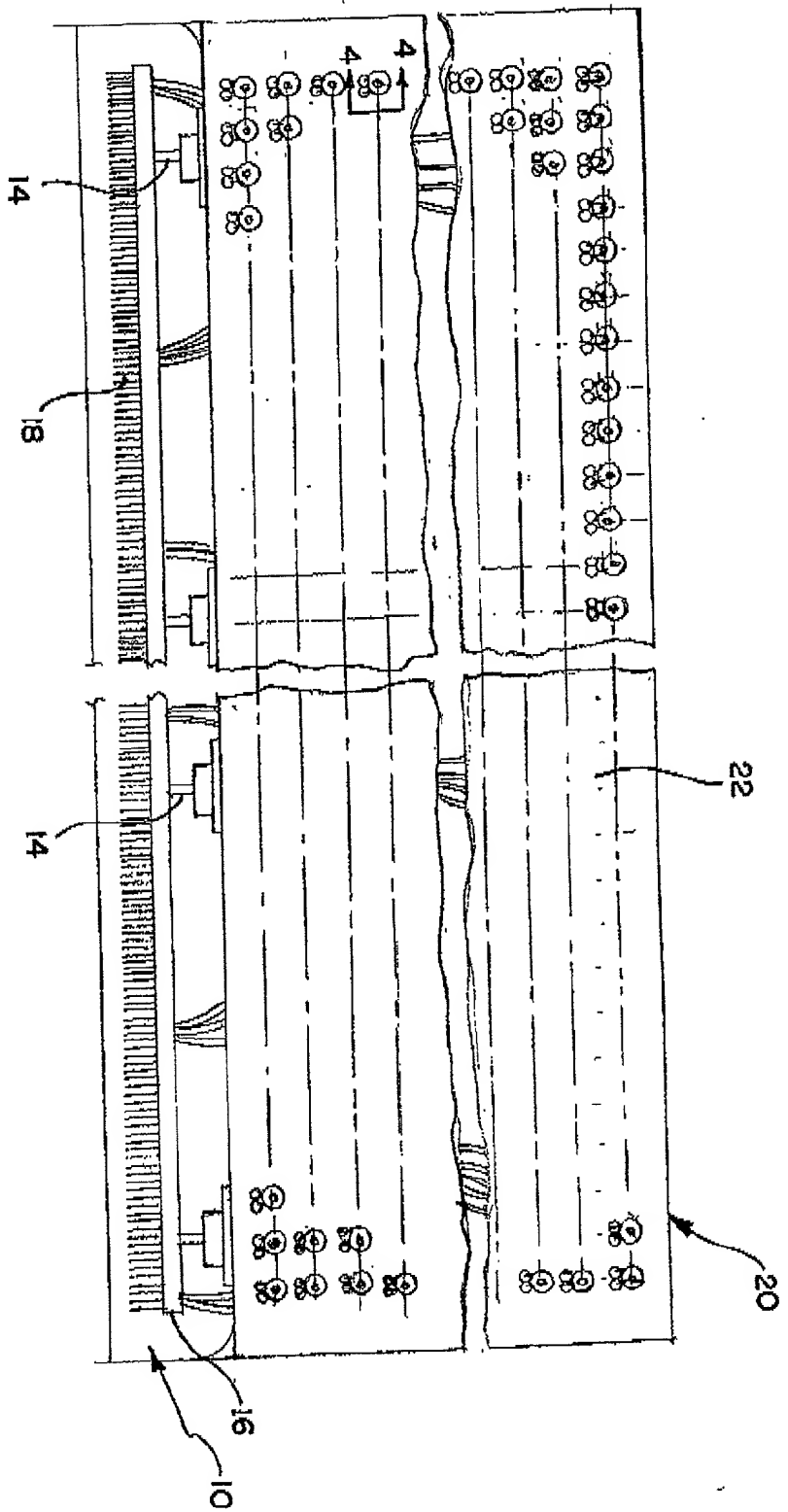


FIG. 1

FIG. 2

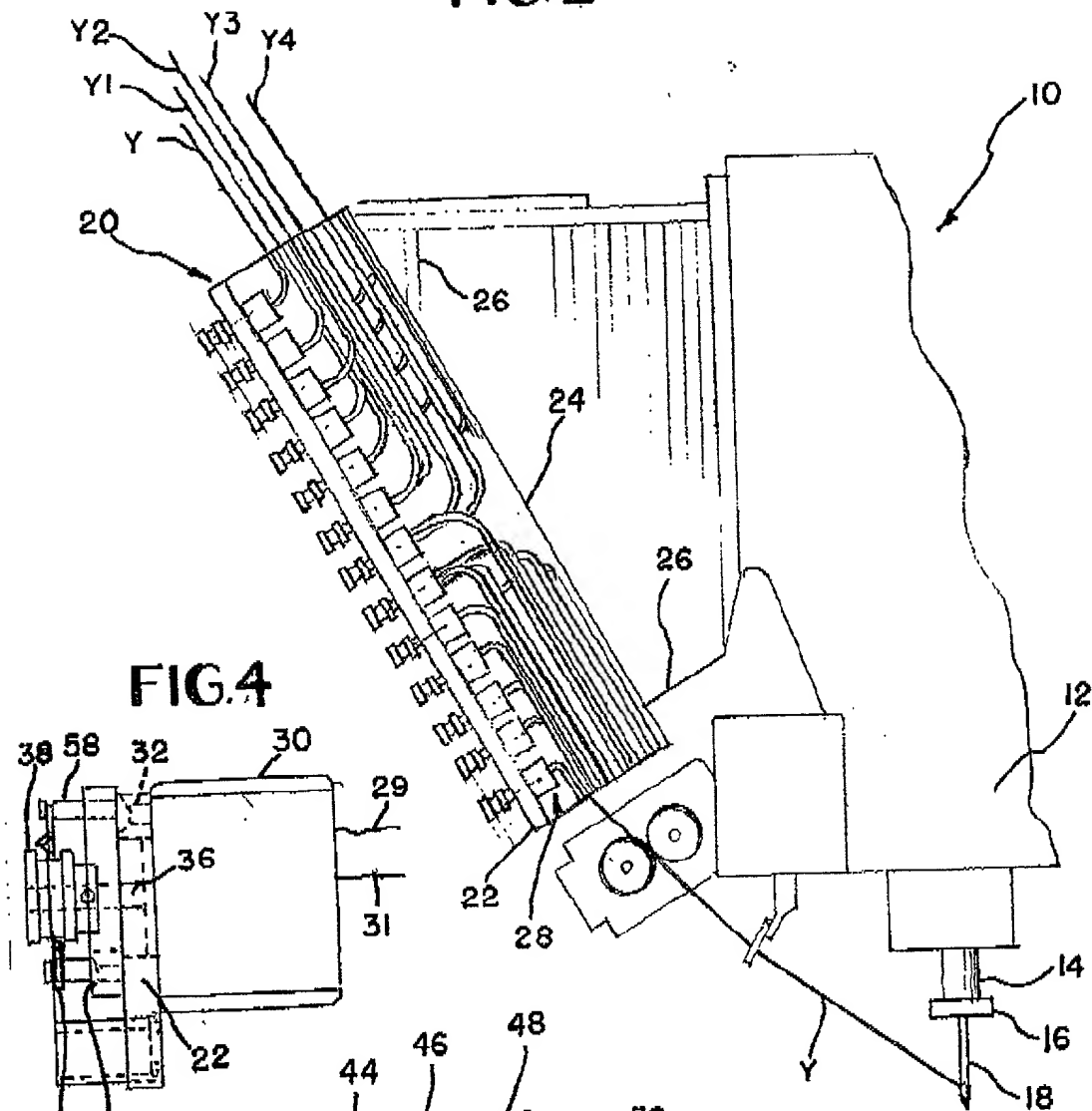


FIG. 4

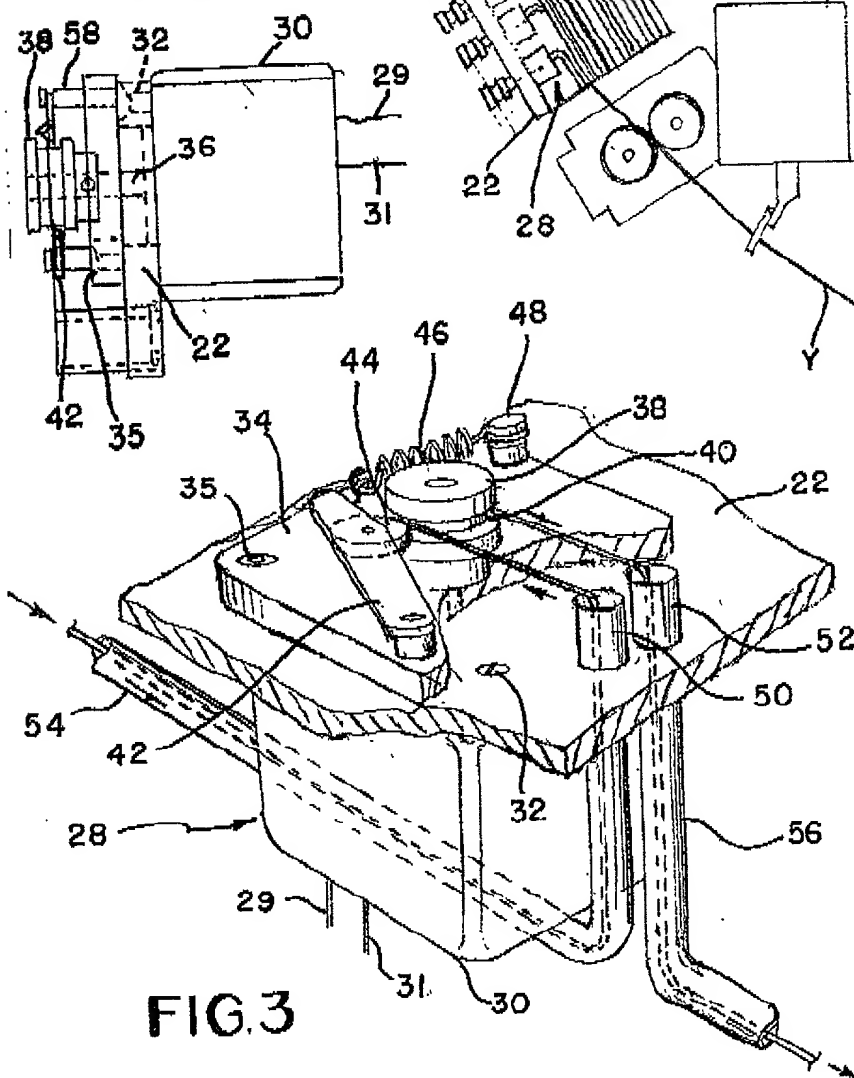


FIG. 3

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63) <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing OR <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	Attorney Docket Number	07012/0100 30,005
	First Named Inventor	Slattery, Ian
	COMPLETE IF KNOWN	
	Application Number	/
	Filing Date	Herewith
	Group Art Unit	
	Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TUFTING MACHINE YARN FEED PATTERN CONTROL

the specification of which (Title of the Invention)

☒ is attached hereto
OR
☐ was filed on (MM/DD/YYYY) [] as United States Application Number or PCT International Application Number [] and was amended on (MM/DD/YYYY) [] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
None			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto
None		

[Page 1 of 2]

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DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
None		

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Customer Number

OR

☒ Registered practitioner(s) name/registration number listed below

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Number Bar Code
Label here

Name	Registration Number	Name	Registration Number
Alan Ruderman	25,369		
Stephen J. Stark	43,152		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

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Address	Suite 1000, Volunteer Building, 832 Georgia Avenue				
City	Chattanooga	State	TN	ZIP	37402-2289
Country	USA	Telephone	(423) 756-6600	Fax	(423) 785-8480

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:

☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))		Family Name or Surname	
Ian		Slattery	
Inventor's Signature	<i>Ian Slattery</i>		Date
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		Country	USA
		Citizenship	British
Post Office Address	5034 Gann Store Road		
Post Office Address			
City	Hixson	State	TN
		ZIP	37343
		Country	USA

☐ Additional inventors are being named on the _____ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto